



Preface

This issue of Infrared Physics & Technology is devoted to a subset of papers representing work present at WIRMS 2003: International Workshop on Infrared Microscopy and Spectroscopy with Accelerator-Based Sources. This international workshop on the infrared science being done with, and the recent advances in, infrared synchrotron and free electron laser sources, was held on July 8–11, 2003 at the Granlibakken conference center at Lake Tahoe, California. This was the second biannual workshop in the series (WIRM 2001 was held in Porquerolles, France) and it was organized and chaired by Michael C. Martin (ALS), Todd I. Smith (Stanford), Wayne R. McKinney (ALS), and Daniel Palanker (Stanford). Support for WIRMS came from the ALS, Stanford, and 5 corporate sponsors. Over 75 participants enjoyed the stimulating scientific presentations, numerous detailed discussions, and the beautiful weather and scenery.

Representatives from the infrared scientific programs at 13 synchrotron light sources and 10 free electron laser facilities participated. WIRMS 2003 had 42 oral and 11 poster presentations in 10 topical scientific sessions. The first session covered Biomedical Spectroscopy including presentations on the Vanderbilt FEL's recent biomedical and surgical applications followed by discussions on IR spectral mapping and analysis of living cells and tissue sections at NSLS and LURE. Talks showed how the high spatial resolution of a synchrotron IR microscopy beamline allows chemical imaging of biological systems and complements other more conventional tools available to the biomedical researcher.

THz Microscopy at Rensselaer Polytechnic Institute and the NSLS was covered in the next

session with examples of the current state of the art including the recent experimental developments at the NSLS U4IR and U12IR beamlines using terahertz frequency synchrotron radiation for microscopy and spectroscopy applications, respectively.

A session on New Sources included several talks about the production and use of coherent synchrotron radiation (CSR) as an emerging powerful source in the terahertz range including some exciting measurements done using the Jefferson Lab's energy recovery linac to produce watt level CSR THz radiation. Groups from BESSY then described how a low-alpha configuration allows stable CSR from a storage ring. Using this source first observations were presented of the Josephson plasma frequency in the high-temperature superconductor $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_8$. A novel Coherent Advanced THz Source (CATS) based on an FEL at Frascati was described. Future directions was covered in a presentation on the design and characteristics of a proposed new CSR facility for Berkeley named CIRCE, Coherent InfraRed Center.

A session on Advanced Techniques included work at Stony Brook on a high field electron spin resonance system using far-IR synchrotron radiation at the NSLS. Non-linear spectroscopy results from work using the FELIX FEL facility was covered as was a lively discussion on the resolution limits for a synchrotron infrared microscope and how to best enhance it.

A session on Environmental & Planetary Sciences, included work at Berkeley using synchrotron IR spectromicroscopy to learn about how bacteria are able to reduce chromium compounds via the production of extracellular chromium

nanoparticles. An overview of recent infrared work on samples at very high pressures was discussed where the use of a diamond anvil cell means that a high brightness source such as a synchrotron is required.

Measurements done on interstellar grains using IR to determine the mineral composition of such grains on a microscopic scale aid in the interpretation of astronomical spectroscopy data and in the understanding of the composition of some of the universe. There was also a session on applying synchrotron IR microscopy to agriculture and ecological systems.

An Applied IR Microscopy session described how synchrotron IR microscopy is aiding in understanding the micro-characterization and reliability of commercially used polymer blends and composites. This was followed by an experimental description of a dark-field technique for IR microscopy and in what situations this would be advantageous.

A Near-field Optical Microscopy for the Beyond the Diffraction Limit session included Stanford's efforts at near-field using transient photo-induced mirrors, apertures, and fresnel lenses, and their plans for coherent anti-stokes Raman scattering. Other discussions covered special techniques including theoretical calculations of the limits and performance of the near-field approach.

Facility News included recent developments at the SOLEIL, ESRF, DAFNE, ANKA, JLab, Korea Atomic Energy Research Institute, ELETTRA, CLS, SLS, and SRC. There are substantial efforts worldwide expanding the use of IR beam-lines on accelerator based light sources due to their ability to achieve higher flux, brightness, bandwidth, and shorter pulse widths than conventional sources.

An Applied IR Spectroscopy session included work at University of Kentucky on microscopic

studies of the electro-optical properties of charge-density-wave systems. Research at the College of William & Mary included vibrational lifetimes of various hydrogen defects in silicon. UCSB THz research centered on semiconductors and how their properties can be modified by the application of strong THz fields. UCSD researchers then discussed artificial metamaterials leading towards left-handed optical systems and a U. Poitiers group presented how far-IR reflectance measurements using a synchrotron allow measurement of surface layer formation and geometry in electrochemical cells.

WIRMS 2003 concluded with a session on Strongly Correlated Materials lead off by UCSD presenting work on using infrared to observe inhomogeneities in the superconducting state of high- T_C cuprate superconductors. LBNL followed with a description of THz time-domain spectroscopy and how to use it as a probe in insulating, conducting and superconducting phases of novel materials. Finally NSLS studies were presented on time-resolved THz spectroscopy using a pump laser synchronized to the NSLS VUV synchrotron light pulses to study MgB_2 and MoGe films.

All involved found the workshop to be stimulating and a great success. WIRMS 2005 is in the initial planning stages to be held in Germany. For more information on WIRMS 2003, including many presentation files and photos, please see: <http://infrared.als.lbl.gov/WIRMS>.

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